PATENT SPECIFICATION

812,666

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COMPLETE SPECIFICATION

Improvements in or relating to Resilient Mounts

We, GENERAL MOTORS CORPORATION, a Company incorporated under the laws of the State of Delaware in the United States of America, of Grand Boulevard in the City of Detroit, State of Michigan, in the United States of America (Assignees of ALLEN L. EVERITT) do hereby declare the invention for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to resilient mounts particularly for motor vehicle engines.

A resilient mount according to the invention comprises a channel plate adapted to be secured to one article, a mass of rubber or like material bonded to the interior of the channel plate, and an attachment plate bonded to the mass of rubber or like material and adapted to be secured to another article, the mass of rubber or like material having a groove adapted to be partially entered by a projection rigid with the second article so that relative movement in a certain direction between the two articles is permitted by flow of rubber or like material into the unentered part of the groove.

Preferably there are a pair of grooves in the mass of rubber or like material, one on each side of the attachment plate and parallel to the side walls of the channel plate. The grooves are adapted to be entered by the legs of a U-shaped element rigid with the second article. Relative movement of the attachment plate towards the base of the channel plate is permitted by flow of rubber or like material into the unentered parts of the grooves.

The scope of the invention is defined by the appended claims; and how it may be performed is hereinafter particularly described with reference to the accompanying drawings in which:

Figure 1 is a front elevation of an engine supported on a chassis, by means of a resilient mount according to the invention;

Figure 2 is a cross section on the line 2—2 of Figure 1;

Figure 3 is a cross section on the line 3—3 of Figure 2;

Figure 4 is a perspective view of a part shown in Figures 2 and 3;

Figures 5, 6 and 7 are graphs showing respectively fore and aft, lateral and vertical load deflection curves;

Figure 8 is a cross section, similar to that of Figure 3, of another resilient mount according to the invention;

Figure 9 is a cross section on the line 9—9 of Figure 8; and

Figure 10 is a graph showing fore and aft, lateral and vertical deflection curves of the resilient mount shown in Figures 8 and 9.

A motor vehicle engine 26 (Figure 1) is supported on a chassis 36 by means of a three-point mounting, two of which are at one end of and at the sides of the engine while the third is at the opposite end on the longitudinal centre line of the engine. The centre mount is shown in more detail in Figures 2, 3 and 4. The mount includes an elongated channel plate 10 of heavy construction, a narrow U-shaped attachment plate 12 disposed between the legs 14 of the plate 10, and a mass of rubber or like material 18 which fills the space between the legs 14 and the base 16 of the plate 10 and is bonded to the inner surfaces of the plate 10. The attachment plate 12 is bonded to the mass 18, its legs being embedded in the mass as shown in Figure 2. Between and parallel to the legs 14 of the channel plate and the legs of the attachment plate 12, there are deep longitudinal grooves 20, which are partly entered by the legs 24 of a U-shaped element 22, which fits around the base of the attachment plate 12. The ends of the legs 14 of the channel plate are covered by a layer 15 of the mass of rubber or like material. As shown in Figure 2 there is a small lateral clearance 25 between the legs 24 of the element 22 and the sides of the grooves 20.

The channel plate 10 is attached to a bracket 28 on the underside of the engine 26 by nut and bolt assemblies 30 so that the axis

[*Price*

of the plate is horizontal and transverse to the longitudinal line of the engine. The attachment plate 12 is secured to the chassis 36 by means of bolts 34 which pass through the base of the U-shaped element 22, and the base of the attachment plate itself to screw into nuts 32 fixed to the internal surface of the attachment plate.

Lateral motion of the engine 26 relative to the chassis 36 is thus only restrained by the elastic resistance of the mass 18 to shear which, as shown in Figure 6, is more or less proportional to the lateral load.

The vertical movement of engine is damped by the resistance of the mass of rubber or like material to distortion. The mass 18 of rubber or like material is substantially incompressible, and movement of the attachment plate 12 towards the channel plate 10 is permitted by distortion of the mass 18 so that rubber or like material flows into the parts of the grooves 20 unoccupied by the legs 24 of the element 22. Thus the permitted relative vertical movement may be controlled by adjustment of the length of the unoccupied parts of the grooves 20; this may be effected by increasing the lengths of the legs 24 or increasing the depth of the grooves 20. Excessive vertical movement of the engine is damped by the layer 15 which covers the ends of the legs 14 of the plate 10. Figure 7 shows a typical vertical load deflection curve from which it can be seen that the vertical movement is approximately proportional to the load.

Longitudinal or fore and aft movement of the engine relatively to the chassis is, for a small deflection corresponding to the clearance 25, which is about 0.025 inches, restrained only by the resistance of the mass 18 to shear. Thereafter such longitudinal movement is restrained to a much greater extent by both the resistance of the mass 18 to distortion and frictional forces between the tongues 27 and 29 of rubber or like material and the side walls and the legs of the plate 12 and element 22 opposing such distortion. Thus there is little damping at low or idling speeds, when there tends to be but small longitudinal movement between the engine and chassis, and heavy damping when the engine is operating at higher speeds. Little engine vibration is therefore transferred to the chassis at idling speeds. This is clearly shown in Figure 5, where a small load produces an initial deflection of about .025 inches while a much larger load is subsequently required to increase the deflection by the same amount.

Mounts, according to the present invention, are economical to manufacture. In making a mount, the channel plate 10 and the attachment plate 12 are positioned in a mould and the rubber or like material is then introduced into the mould, the grooves 20 being formed in the same operation. The element 22 is separately formed by a single stamping operation. Figures 8 and 9 show a modification of the mount just described. The U-shaped attachment plate 12 is replaced by a prismatic plate 50 bonded in a recess in a mass 44 of rubber or like material corresponding to the mass 18. A channel plate 46, which corresponds to the channel plate 10, has inturned ends 38 to which the mass 44 is bonded. Between the inturned ends 38 and the ends of the block 50, there are transverse grooves 42 which are parallel to the ends 38 and meet longitudinal grooves 43 corresponding to the grooves 20. A tongue 40 of rubber or like material separates each groove 42 from an inturned end wall 38, while a tongue 53 separates it from an end of the block 40. There is a U-shaped element 52 corresponding to the element 22 above, whose legs partially enter the longitudinal grooves 43. If desired, for reasons explained below, the ends of the element 52 may have inturned flanges which enter the transverse grooves 42.

The prismatic plate 50 is attached to a chassis by means of a bolt whose head engages the unexposed side of the plate.

The inturned ends 38 in conjunction with the transverse grooves 42 limit lateral relative movement between the engine and chassis so that a relatively small load is required to produce a small deflection, that is until a tongue 53 abuts against a tongue 40, while a proportionately greater load is required for a subsequent similar deflection. Before the tongue 53 abuts against the tongue 40, the only resistance to the relative lateral movement is elastic resistance of the mass 44 to shear, while thereafter it is the resistance of the mass 44 to distortion and frictional forces tending to prevent such distortion. Distortion tends to cause some of the mass 44 to flow so as to enter the grooves 42. The amount of deflection can therefore be adjusted for a given size of groove 42 by means of inturned end flanges on the element 52, the end flanges functioning similarly to the legs 24 of the element 22 described above with reference to Figures 2 to 4.

Typical load deflection curves for the mount illustrated in Figures 8 and 9 are shown in Figure 10. The fore and aft and vertical deflection curves are substantially the same as those shown in Figures 5 and 7 respectively. The lateral load deflection curve is, however, different in that the gradient of the curve increases sharply at large deflection, the point of increase being when the tongue 53 abuts against the tongue 40.

A resilient mount according to the invention is readily adaptable to a considerable variation in performance. Thus as pointed out above the vertical load deflection curves can be altered by changing the depth of the grooves 20 or 43 or the height of the legs 24 of the element 22. Fore and aft load deflec-

tion curves can be altered by adjusting the clearance 25 or the thickness of the legs 24, and the lateral load deflection curves can be altered by the presence of the flanges 38 and the grooves 42 (Figures 8 and 9). The dimensions of the grooves and legs can be accurately controlled in the manufacture of the mount so that mass production of mounts of uniform performance is facilitated.

By the term " rubber or like material " used herein, is meant any of the relatively soft rubbers conventionally used in motor mounts, and includes natural rubber, butadiene-styrene copolymers, butadiene-acrylonitrile copolymers, polychloroprene and mixtures of these and similar materials.

WHAT WE CLAIM IS:—

1. A resilient mount comprising a channel plate adapted to be secured to one article, a mass of rubber or like material bonded to the interior of the channel plate, and an attachment plate bonded to the mass of rubber or like material and adapted to be secured to another article, the mass of rubber or like material having a groove adapted to be partially entered by a projection rigid with the second article so that relative movement in a certain direction between the two articles is permitted by flow of rubber or like material into the unentered part of the groove.

2. A resilient mount comprising a channel plate adapted to be secured to one article, a mass of rubber or like material bonded to the interior of the channel plate, and an attachment plate bonded to the mass of rubber or like material and adapted to be secured to another article, the mass of rubber or like material having a pair of grooves one on each side of the attachment plate and parallel to the side walls of the channel plate, the grooves being adapted to be partially entered by legs of a U-shaped element rigid with the second article so that relative movement of the attachment plate towards the base of the channel plate is permitted by flow of rubber or like material into the unentered parts of the grooves.

3. A resilient mount according to claim 1 or claim 2 in which the attachment plate is U-shaped, and is bonded to the mass of rubber or like material so that its base and legs are respectively parallel to the base and sidewalls of the channel plate, the legs entering grooves in the mass of rubber or like material.

4. A resilient mount according to claim 1 or claim 2 in which the attachment plate is a block bonded in a recess in the exposed face of rubber or like material.

5. A resilient mount according to any of the preceding claims having fixed to the attachment plate a nut into which a bolt for securing the second article to the attachment plate screws.

6. A resilient mount according to claim 6 in which the bolt also serves to secure the projection or U-shaped element to the second article.

7. A resilient mount according to any of claims 1 to 4 in which a bolt for securing the attachment plate to the second article passes through the attachment plate, so that its head engages the non-exposed surface of the attachment plate.

8. A resilient mount according to any of the preceding claims in which the channel plate has an inturned end wall, and there is a groove in the mass of rubber or like material parallel to and between an end of the attachment plate and the inturned end wall.

9. A resilient mount according to any of the preceding claims in which there is a small clearance between the projection or arms of the U-shaped element and the side of the groove or grooves so as to permit easy but limited movement of the attachment plate towards the side walls of the channel plate.

10. A resilient mount according to any of the preceding claims in which the ends of the side walls of the channel plate are covered by the rubber or like material.

11. A resilient mount substantially as hereinbefore particularly described with reference to Figures 1 to 4 of the accompanying drawings.

12. A resilient mount substantially as hereinbefore particularly described with reference to Figures 8 and 9 of the accompanying drawings.

13. The combination of a resilient mount according to any of the preceding claims and a projection or U-shaped element adapted both to enter the groove or grooves and to be secured to the second article.

14. A motor vehicle in which the engine is mounted on the chassis by means of a combination according to claim 13.

15. A motor vehicle according to claim 14 in which the mount is disposed at one end, and on the longitudinal centre line, of the engine with the channel plate horizontal and perpendicular to the longitudinal centre line.

16. Motor vehicle having a three-point mounting for its engine, two of the mounts of the mounting being at one end of and at the sides of the engine and the third mount being at the opposite end and on the longitudinal centre line of the engine, the third mount comprising a channel plate with its base secured to the engine so that it is horizontal and transverse to the longitudinal line, a mass of rubber or like material bonded to the interior of the channel plate, and an attachment plate bonded to the mass of rubber or like material and secured to the vehicle chassis, the mass of rubber or like material having a pair of grooves one on each side of the attachment plate and parallel to the side walls of the channel plate, the grooves being partially entered by legs of a U-shaped element rigid with the chassis,

there being a small clearance between the arms of the element and the sides of the grooves so as to permit easy but limited movement of the attachment plate towards the side walls of the channel plate and a substantial distance between the ends of the legs of the element and the base of the grooves so that relative vertical movement between chassis and engine is permitted by flow of rubber or like material into the unentered parts of the grooves.

E. WILLIAMSON,
Chartered Patent Agent.

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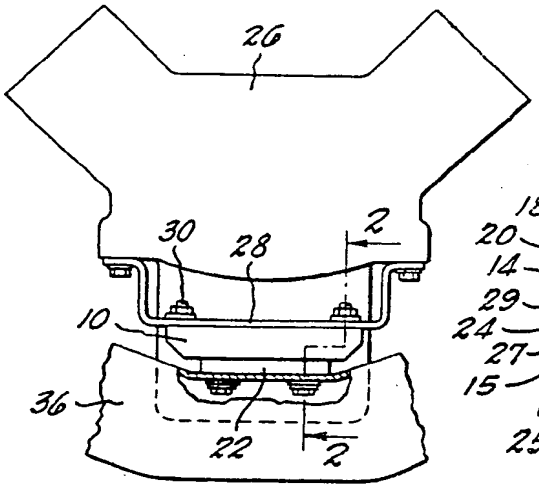
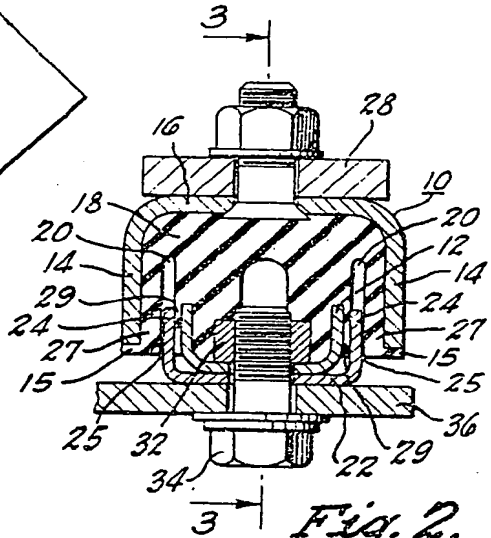


Fig. 1



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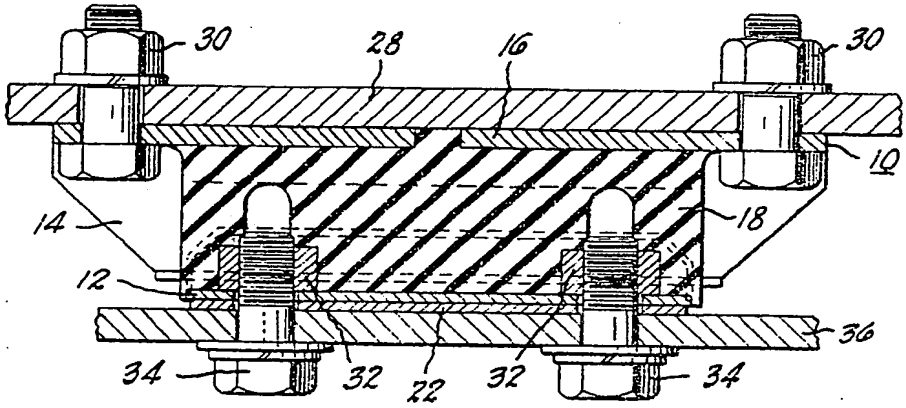

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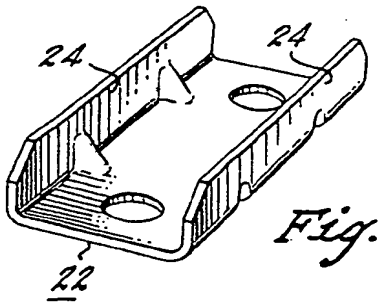

Fig. 4.

812,666 COMPLETE SPECIFICATION

2 SHEETS

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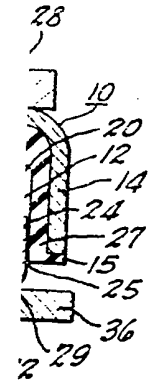
SHEETS 1 & 2



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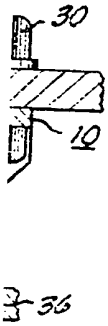

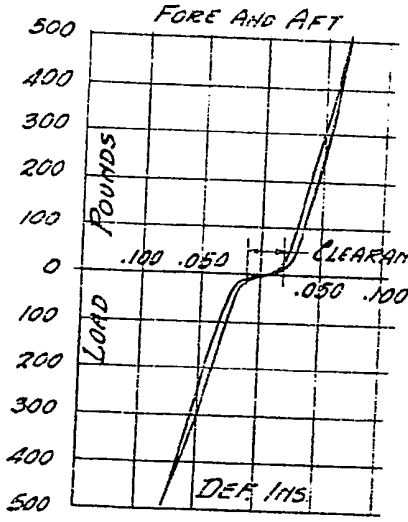

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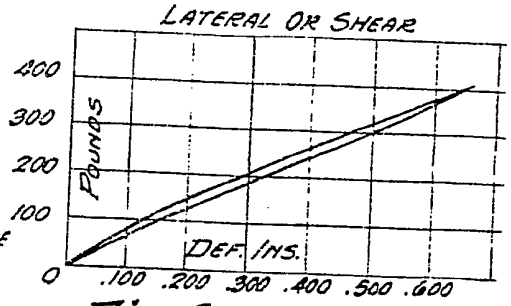

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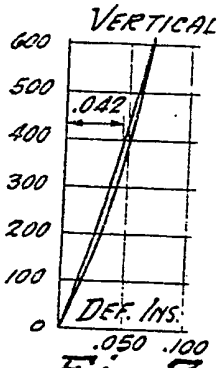

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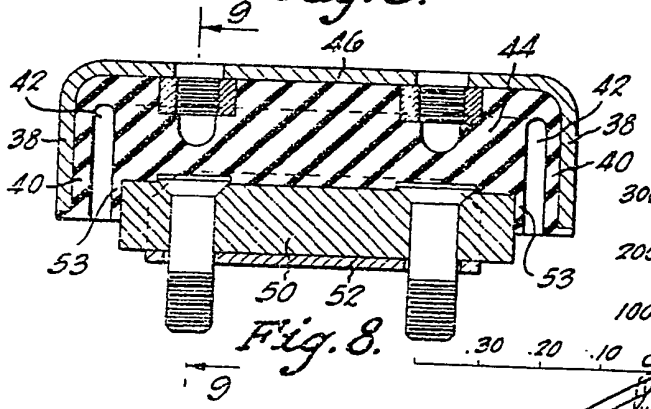

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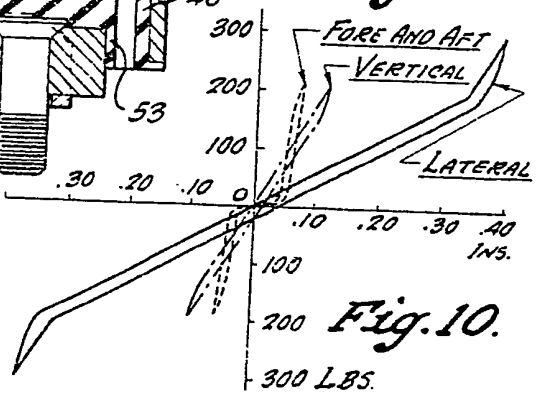

Fig. 10.

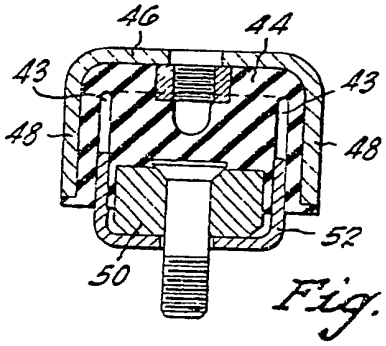

Fig. 9.

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SHEETS 1 & 2

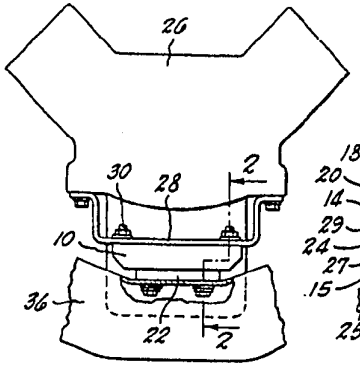
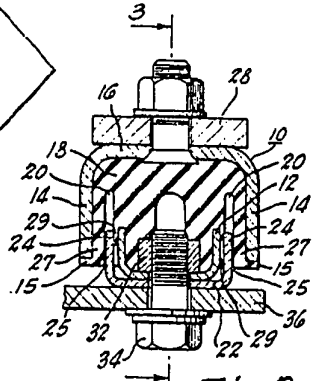


Fig. 1



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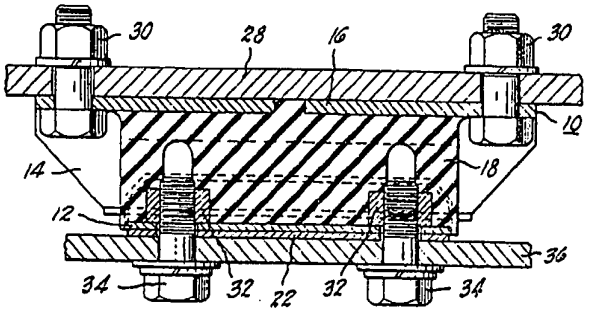

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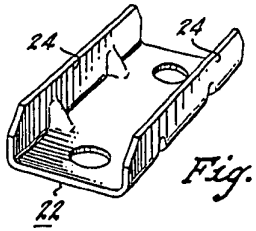

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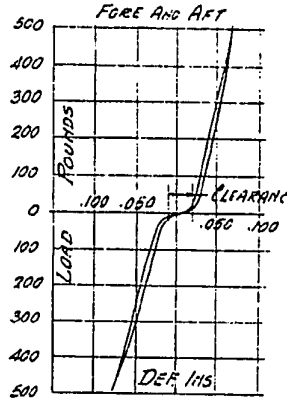

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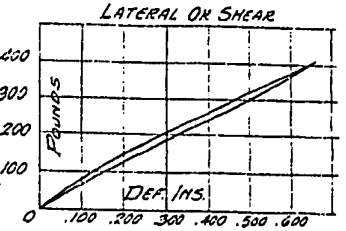

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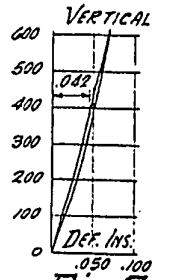

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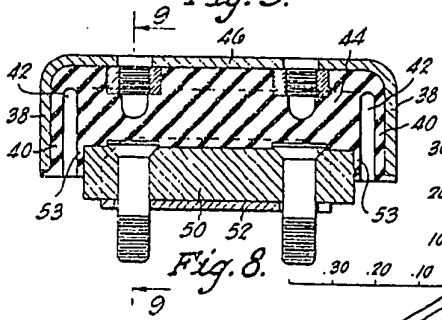

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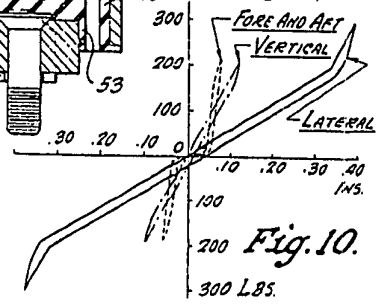

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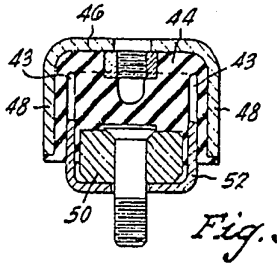

Fig. 9.